CSOC **Consolidated Space Operations Contract**

Interface Agreement
Between the
Network Control Center Data System (NCCDS) and the
WSC TCP/IP Data Interface Service Capability (WDISC)

October 16, 2002

Effective: October 16, 2002

Contract No. NAS9-98100

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Document History			
Document Number	**Status/Issue**	**Publication Date**	**Effective Date**
CSOC-GSFC-AGR-003001	Original	October 16, 2002	October 16, 2002

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DCN Control Sheet

DCN Number	Date/Time Group (Electronic DCN Only)	Month/Year	Section(s) Affected	Initials

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Preface

The information contained in this document applies to the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Network Control Center Data System (NCCDS) and the White Sands Complex (WSC) Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC). In this document, a detailed definition of the electronic high-speed message communications interface between the NCCDS and the WDISC is covered.

This document is under configuration management of the Goddard Space Flight Center (GSFC) WDISC Sustaining Engineering Review Board (SERB). Proposed changes to this document must be submitted to the SERB along with supportive material justifying the proposed change. Changes to this document will be made by Documentation Change Notice (DCN) or complete revision.

Comments or questions concerning this document and proposed changes shall be addressed to:

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Section 1. Introduction

1.1   Purpose

The purpose of this document is to provide a detailed definition of the message communications interface between the Network Control Center (NCC) Data System (NCCDS) and the White Sands Complex (WSC) Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC).

1.2   Scope

This Interface Agreement provides a brief description of the NCCDS and the WDISC. It defines the messages and message formats of the interface between the NCCDS and the WDISC.

Section 2. Applicable Documents

2.1   General

The documents listed in this section are either applicable to the NCCDS/WDISC interface or serve as references for the information presented in this Interface Agreement.

2.2   Specifications

a. *WDISC Critical Design Review,* April 25, 2002

b. *Data Services Management Center (DSMC) System Requirements Specification,* CSOC-CEN.SE11.001070, Rev. D

c. *Network Control Center Data System (NCCDS) Functional Management Plan,* NCCDS-PLAN-001, Mod 4, October 12, 2001

d. *WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Operations Concept,* Revision 1, December 1998

e. *WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) System Requirements,* Initial Capability, July 1998

f. *WSC Transmission Control Protocol (TCP)/Internet Protocol (IP) Data Interface Service Capability (WDISC) Service Specification,* Revision 1, December 1998

Section 3. System Descriptions

3.1   General

This section provides background information regarding the basic functions of the NCCDS and the WDISC.

3.2   NCC Data System Description

The Spaceflight Tracking and Data Network (STDN) is a complex communications network encompassing the Space Network (SN), Ground Network (GN), and all support facilities necessary to provide tracking, telemetry, and command support to customers. The NCC is the STDN element responsible for overall coordination of network resources to satisfy the support requirements of all network customers. The NCCDS provides the electronic interface to SN elements and customers.   The NCCDS schedules, controls, and monitors SN resources. The NCCDS nodes performing these functions run on the HP-UX operating system.

3.3   WDISC System Description

The WDISC provides customers with TCP/IP access to WSC computing resources in support of telemetry and command processing. The WDISC uses a Programmable Telemetry Processor (PTP) – a commercial off-the-shelf (COTS) product running on the Windows NT 4.0 operating system – to provide the required capabilities. The WDISC is compatible with the Consultative Committee for Space Data Systems (CCSDS) Telemetry and Telecommand services.

The WDISC provides TCP/IP customers access to SN services provided by WSC using local interfaces (LIs). The WDISC supports the following functional capabilities:

  a. Receive encapsulated forward service data from a Mission Operations Center (MOC), convert data to serial form, and present it to a WSC local interface (LI) port.

  b. Receive serial return service data from a WSC LI port, encapsulate it, and transmit it to a MOC.

  c. Data monitoring of customer forward and return service data.

  d. Data recording.

  e. Data playback.

  f. Provide real-time status on forward and return service data.

Section 4. Interface Configuration and Control

4.1 General

WDISC support interfaces and data are provided through the NASA Integrated Services Network (NISN) Closed IP Operational Network (IONet), extending to Open IONet for specific customers. The WDISC operates within the Data Interface System (DIS) element of the WSC and is controlled and configured by the NCC.

4.2 Host Configuration

The DIS of each WSC ground terminal contains a set of PTPs, each containing two PTPs. One set is located at WSGT and another is located at STGT. Each PTP contains three processing boards. Each board is connected to a specific forward LI port and a specific return LI port as identified by the UIFC. Thus, each board is capable of supporting a single forward and return data stream for the same event.

4.3 Timing Constraints

The PTP WDISC event schedule needs to arrive at the PTP at least one minute prior to the WDISC event start time to ensure that the desktop can be loaded and the TCP/IP connections can be established in time. The PTP will not accept any WDISC event more than 72 hours in the future.

4.4 Data Requirements

For every WDISC event scheduled on a PTP board there are, at most, two unique "desktops" associated with it. In other words, a desktop is associated with each WDISC event scheduled on a PTP board and the desktop for the prime PTP board may be different than the desktop for the backup PTP board. The names of these desktops are determined by comparing the combination of SUPIDEN, forward UIFC, return UIFC, forward data rate and return data rate in the schedule request to the desktop mappings in the NCCDS database.

4.5 TCP/IP Connection Management

The transmissions from the NCCDS to the WDISC PTP Scheduling Server (PSS) will be over TCP/IP on port 3999. The PTP will accept one message/request from the NCC, return a status to the NCC, and then close the connection.

Table 4-1. WDISC Services

Service Name	Service Type	Open Service Port Number	PTP command	Nominal Duration	Client
WdiscReq	PTP schedule	3999	Command, Delete, Data	1 message per connection	WdiscSrvReqClient

4.6   Data Organization Strategies

The HP-UX machine uses the "Big Endian" byte order. The Windows NT PC machine uses the "Little Endian" byte order. As a result the NCCDS software translates all numeric data from the "Big Endian" byte order to the "Little Endian" byte order prior to sending the data on the socket and performs the reverse translation when receiving data.

Section 5. Message Flow

5.1 General

This section describes the general flow of data from the NCCDS to the WDISC and back. Refer to Section 6 for the format of the messages flowing between the NCCDS and the WDISC.

5.2 WDISC Message from NCCDS (PTP command)

When an event is scheduled by the NCCDS using a WDISC UIFC, the NCCDS will transmit a PTP Data command to the appropriate set of PTPs. This PTP Data command provides only the scheduling information that is needed to correctly process and transport data between the MOC and the LI at WSC.

PTP Delete commands are used to delete WDISC events from the PTPs. If a Space Network event that specifies WDISC support is deleted from the NCCDS and the PTP Data command was already transmitted to the WDISC, the NCCDS will send a PTP Delete command to remove the event from the appropriate WDISC PTP machine(s).

There are other messages sent to the WDISC that are not specific to the adding or deleting of a WDISC event. These are called PTP Command messages and they are described in further detail in Section 6.

5.3 WDISC Response to NCCDS (PTP response)

Upon receipt of a PTP command, the WDISC will issue a PTP response to the NCCDS indicating acceptance or rejection. These responses are described in further detail in Section 6.

Section 6. Message Format

6.1   General

This section provides the actual message format of PTP commands sent from the NCCDS to the WDISC and WDISC responses sent back to the NCCDS. **NOTE:** All character field types are left justified.

6.2   WDISC Message from NCCDS (PTP command)

There are three different types of PTP commands: Data, Delete, and Command.

<u>NOTE</u>

The NCCDS does not use "Command", however it is included here for completeness.

Table 6-1. PTP Data command and PTP Delete command format

Item #	# of Bytes	Start Byte	Data Item	Range of Values (or Field Type)
1	4	1	Header	"tmd" Indicates a PTP data command "tmx" Indicates a PTP delete command
2	4	5	Subheader	integer 0
3	16	9	PTP server IP address	16 char
4	4	25	Port	unsigned long
5	64	29	Desktop	64 char
6	4	93	Event Start	long *
7	4	97	Event Stop	long *
8	4	101	Forward Service Start	long * (not implemented – set to current time)

Item #	# of Bytes	Start Byte	Data Item	Range of Values (or Field Type)
9	4	105	Forward Service Stop	long * (not implemented – set to current time)
10	4	109	Forward Service Flag	integer 0 = false

* Start and stop times are displayed in number of seconds since January 1, 1970.

Table 6-2. PTP Command format

Item #	# of Bytes	Start Byte	Data Item	Range of Values (or Field Type)
1	4	1	Header	"tmc" Indicates a PTP command
2	4	5	Subheader	integer -1 = No operation 0 = Stop the server 1 = Copy the timer database to the logfile 2 = Swap logfiles

6.3   WDISC Responses to NCCDS (PTP response)

The following are WDISC PTP responses to PTP commands sent from the NCCDS.

Table 6-3. PTP response format

Item #	# of Bytes	Start Byte	Data Item	Range of Values (or Field Type)
1	4	1	WDISC Response Header	"tmr" Indicates a PTP response

Item #	# of Bytes	Start Byte	Data Item	Range of Values (or Field Type)
2	4	5	WDISC Response Number	integer 0 = OK 1 = Unrecognized command 2 = No desktop file found 3 = Bad times * 4 = No forward service file 5 = Deleted schedule service

* If a PTP Data command was previously accepted by the WDISC, then a retransmission of this command will be rejected with a response of 3.

If the WDISC response is either 0 or 5 then the NCC will log that message. If the WDISC response is 1, 2, 3, or 4 then the NCC will log that message and alert the operator.

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Abbreviations and Acronyms

CCSDS	Consultative Committee for Space Data Systems
COTS	commercial off-the-shelf
DCN	Document Change Notice
DIS	Data Interface System
DSMC	Data Services Management Center
FTP	file transfer protocol
GN	Ground Network
GSFC	Goddard Space Flight Center
IA	Interface Agreement
ICD	Interface Control Document
IONet	IP Operational Network
IP	Internet Protocol
LI	local interface
MOC	Mission Operations Center
NASA	National Aeronautics and Space Administration
Nascom	NASA communications
NCC	Network Control Center
NCCDS	NCC Data System
NES	Nascom Event Schedule
NISN	NASA Integrated Services Network
PTP	Programmable Telemetry Processor
SAR	schedule add request
SERB	Sustaining Engineering Review Board
SHO	scheduled service order
SHO ID	scheduled service order identification
SIC	Support Identification Code
SN	Space Network
SPSR	Service Planning Segment Replacement

SSC	service specification code
STDN	Spaceflight Tracking and Data Network
STGT	Second TDRSS Ground Terminal
SUPIDEN	support identifier
TCP/IP	Transmission Control Protocol/Internet Protocol
TDRS	Tracking and Data Relay Satellite
TDRSS	TDRS System
UIFC	user interface channel
USM	user schedule message
WDISC	WSC TCP/IP Data Interface Service Capability
WSC	White Sands Complex
WSGT	White Sands Ground Terminal

Glossary

Acknowledgment	Confirmation of receipt of a message, according to communications protocol.
Customer	An entity that makes use of the STDN.
Desktop	A file that defines the nominal configuration of the PTP required by each customer.
Event	All related services (forward link, return link, tracking and simulation service) for a single TDRS, and a single SUPIDEN, for one continuous SN support period.
Ground Network (GN)	A NASA institutional resource consisting of the ground stations at Merritt Island/Ponce de Leon and Wallops that provide tracking and data acquisition services to approved spacecraft missions.
High-speed message	A message passed from computer to computer over high-capacity data lines.
Interface Channel	A Nascom communication data channel connecting SN elements and control centers.
Schedule Add Request (SAR)	A specific schedule request to add a single event to the schedule.
Scheduling Order (SHO)	A message sent to the WSC that defines the scheduled services and parameter values for a particular event. Each SHO has a unique identifier called the SHO ID.
Second TDRSS Ground Terminal (STGT)	One of two ground facilities for support and control of TDRS and communications services.
Service	A service describes a functional type of support for a user for a continuous period of time. Services include forward links, return links, tracking, end-to-end test, and playback.
STDN Functional Elements	TDRS, GN, NCC, WSC, Vandenberg Air Force Base Relay, DSN, Bilateration Ranging Transponder System, Compatibility Test Van, SOC, FDF, Nascom, Merritt Island Tracking Station.
Spaceflight Tracking and Data Network (STDN)	A combination of the GN and SN.

Support Identification Code (SIC)	The unique four-character numeric indicator for a mission. Refer also to Support Identifier.
Support Identifier (SUPIDEN)	A seven-character code used to identify the satellite or task being supported. It is broken into three parts: class, SIC, and function. Class identifies the major entity for which the support is being provided. The SIC identifies the mission being requested. The function is an identification of the type of support being provided.
Tracking and Data Relay Satellite (TDRS)	A communications relay satellite used as the link between the TDRSS ground station and the user satellites.
White Sands Complex (WSC)	The entire ground segment of the TDRSS located at White Sands, New Mexico.
White Sands Ground Terminal (WSGT)	One of two ground facilities for support and control of TDRS and communications services.